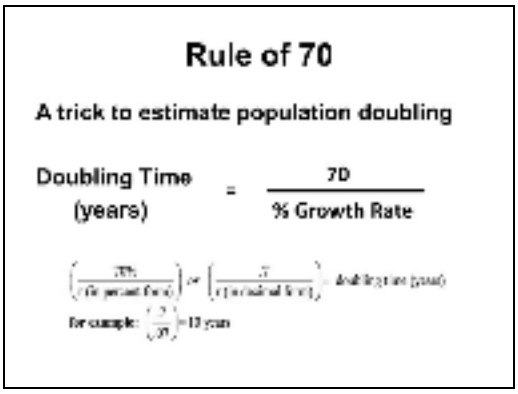
# Population Dynamics

## Population Size

- Population size is estimated using sampling techniques (because can't count every individual) through counting the number of individuals in the larger overall area
- Signs of a healthy population
    - Population increases or remains steady
- Signs of an unhealthy population
    - Population size declines quickly (which can lead to extinction)
- The population size can decrease, increase, follow a cycle, or remain the same
- Doubling time

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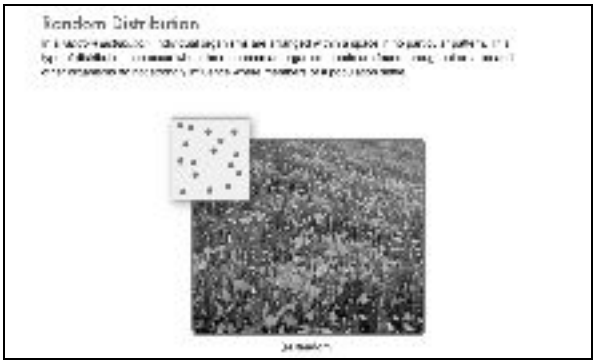
## Population Density

- Low population densities and high population densities
- Larger organisms have lower population densities because they require more resources (thus more room)
- Density makes it easier for organisms to group together and find mates
- Higher density…
    - Leads to conflict as individuals compete for resources
    - Makes species more vulnerable because they are in close contact and therefore more infectious diseases can be easily transmitted
- Low density…
    - Organisms benefit from more space
    - … but have a harder time locating mates and companions

## Population Distribution

- Three distributions

- 

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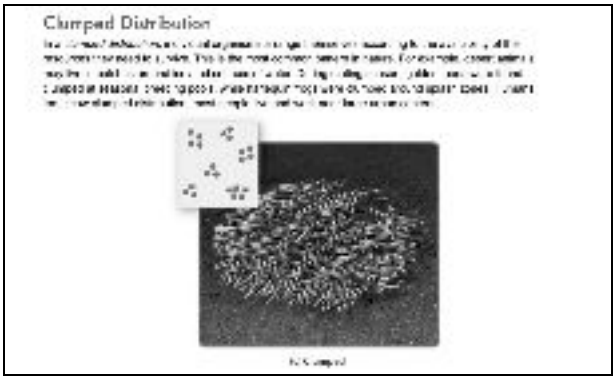
- 

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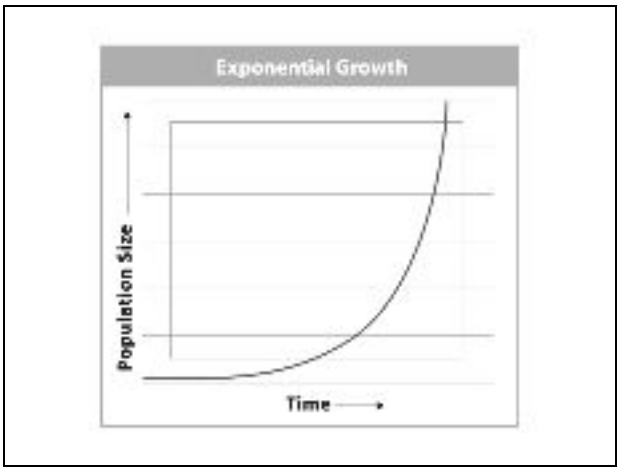
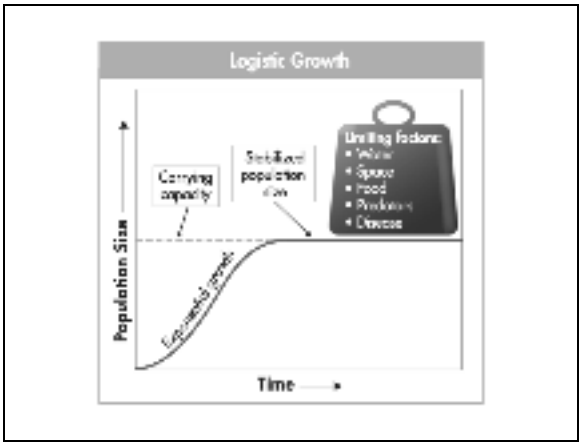
**Population Growth**

- Two factors influence population: births and deaths, and immigration and emigration
- When a population's birthrate is greater than its death rate, the population size increases

- When a population's death rate is greater than its birthrate, the population decreases
- Calculating  population growth → tells us the net change in a population
    - (individuals added) - (individuals subtracted) or (birthrate + immigration rate) - (death rate + emigration rate)
    - Shrinking populations have negative population growth
    - Positive population growth indicates the population is getting larger
- Two basic patterns of population growth
    - Exponential
        - When a population increases by a fixed percentage each year

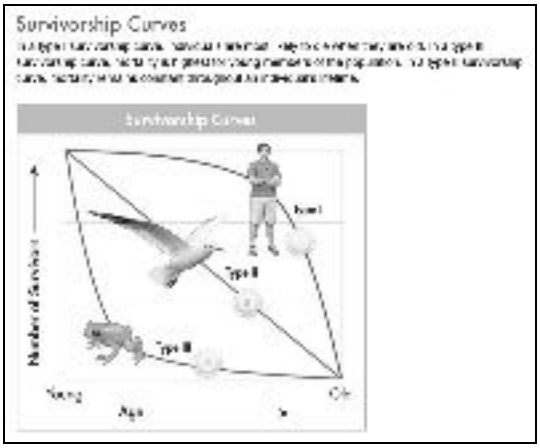


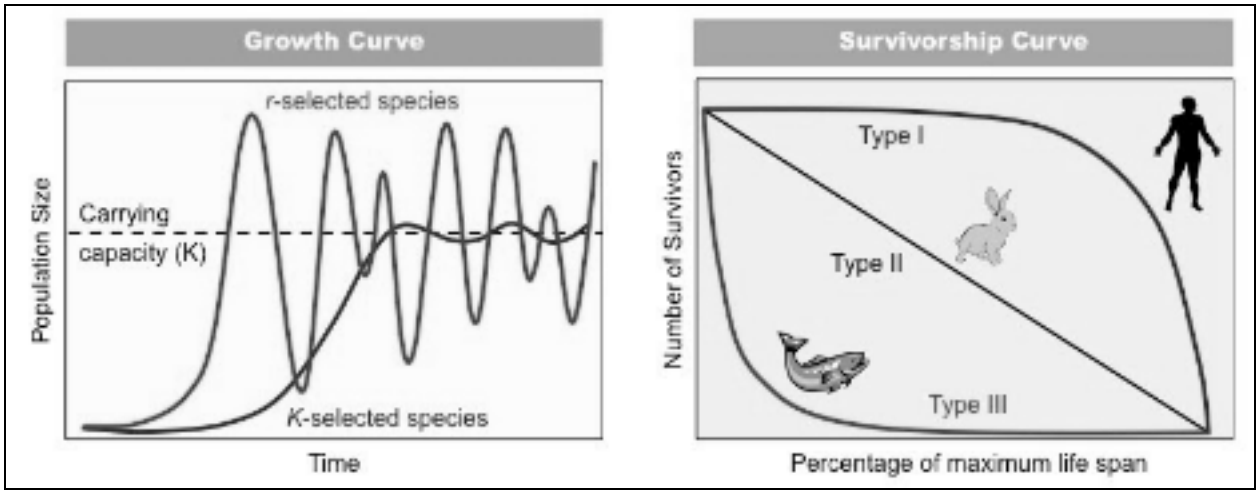

    - Logistic
        - Exponential growth rarely lasts long




        - Limiting factors determine a population's carrying capacity

**R & K Species**

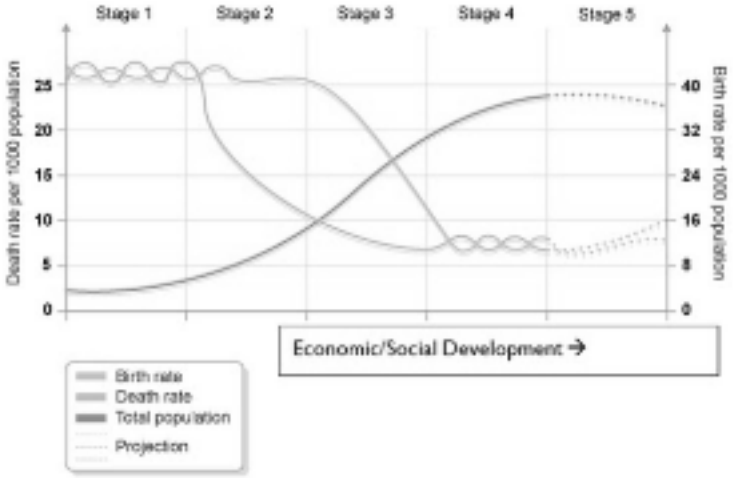



| r<br>Unstable environment, density independent | K<br>Stable environment, density dependent interactions |
|---|---|
| small size of organism | large size of organism |
| energy used to make each individual is low | energy used to make each individual is high |
| many offspring are produced | few offspring are produced |
| early maturity | late maturity, often after a prolonged period of parental care |
| short life expectancy | long life expectancy |
| each individual reproduces only once | individuals can reproduce more than once in their lifetime |
| type III survivorship pattern<br>in which most of the individuals die within a short time but a few live much longer | type I or II survivorship pattern<br>in which most individuals live to near the maximum life span |

**Demographic Transition Model**

- The Demographic Transition Model (DTM) is based on historical population trends of two demographic characteristics (birth rate and death rate) to suggest that a country's total population growth rate cycles through stages as that country develops economically




**Vocabulary**

- Population size: (n.) the number of individual organisms present in a given population of the time.
- Doubling time: (n.) time it takes for a population to double in size
- Population density: (n.) the number of individuals within a population per unit area.
- Population distribution: (n.) how organisms are arranged within an area
- Natality: (n.) the rate at which individuals are born
    - # of births/1000 individuals
- Mortality: (n.) the rate at which individuals die
    - # of deaths/1000 individuals
- Survivorship curves: (n.) the likelihood of death varies with age
- Immigration: (n.) the arrival of individuals from outside a given area
- Emigration: (n.) the departure of individuals from a given area
- Migration: (n). Seasonal movement into and out of an area
- Carrying capacity: (n.) Largest population size a given environment can sustainably support
- Limiting factors: (n.) characteristics of the environment that limit population growth